December 1995

What is the Best Energy Supplement for Thin Cows on Low-Quality Roughages?

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Proceedings, The Range Beef Cow Symposium XIV
December 5, 6 and 7, 1995, Gering, Nebraska

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INTRODUCTION

Thin cows on low-quality roughages are the most challenging group of animals to deal with for beef cow producers in the Northern Great Plains. Typically, this situation occurs during the late fall/winter/early spring months, when the additional nutrient requirements for fetal development or lactation are needed. In this region, cows are often exposed to unfavorable weather conditions, which also increases nutrient requirement. Since thin cows have less outside fat, and therefore less insulation, they have to expend more nutrients to maintain body temperature than cows with adequate body condition. When these nutrient requirements are combined with the need to increase body weight gain in order to prevent calving and rebreeding problems, meeting the energy requirements may be an impossible task with low-quality forage. A much better situation would be to enter this period with cows in satisfactory condition to prevent the need for additional weight gain.

PROTEIN VS ENERGY SUPPLEMENTS

Supplements are often classified or sold as either protein supplements or energy supplements. This conventional classification system is somewhat misleading. In reality, natural protein supplements for beef cows usually contain similar energy levels as energy supplements. For example, nutrient composition tables from NRC (1984) list the TDN level of soybean meal between 84 to 87% depending on the product, while the TDN content of corn and barley is listed as 90% and 84%, respectively.

Feed consumed by the beef cow is subjected to microorganisms in the rumen. Depending on a feed's susceptibility to microbial breakdown, large changes may take place with the feed before it leaves the rumen. It is very common for a certain percentage of the protein in the diet to be deaminated (removal of the nitrogen component of the amino acid), resulting in two compounds, ammonia (the nitrogen component) and a carbon chain. Depending on the nutrient requirements of the ruminal microorganisms, the carbon chain may be used to build a new amino acid or may be used as an energy source. A similar series of reactions can occur inside the animal's body depending on the animal's requirement, allowing protein to be funneled toward meeting either the protein or energy requirement of the animal. A more thorough discussion on this topic can be found in the paper titled "Improving Rebreeding Through Protein Supplementation" in this section.

Protein supplementation can be used to improve energy intake of the animal. Low-

quality or mature forages are usually deficient in both energy and protein, resulting in a lower efficiency of fermentation in the rumen. In most cases with these types of forages, protein is the first limiting nutrient for optimum microbial fermentation. Supplemental protein will improve microbial fermentation, resulting in greater digestibility of the forage which increases the energy available to the animal. The improvement in digestibility allows for increased intake of the forage, also increasing energy intake from the forage. Data to support this statement are shown in Table 1 (Gaebe et al., 1994). When soybean meal was supplemented at 1.34 lbs of dry matter, forage TDN was improved by 16.2% (i.e., 39.9% to 46.4% TDN). The energy from soybean meal increased the diet TDN to 49.4%, compared to only 39.9% TDN of the animal consuming only forage. So by using a protein supplementation, TDN from the forage has been improved. Protein supplementation also improved forage intake by 72%. The combination of improvement of TDN of the forage and intake of the forage results in 100% more TDN intake from forage due to protein supplementation. This improvement does not include the TDN contributed to the diet from the soybean meal.

Table 1. Energy intake of steers (1000 lbs basis) consuming a low-quality, mature forage (5.2% CP) and supplemented with soybean meal[a]

	No supplement	Soybean meal	Difference, %
TDN, %			
Diet	39.9	49.4	23.8
Forage	39.9	46.4	16.2
Dry matter intake, lbs			
Diet	10.7	20.0	86.9
Forage	10.7	18.4	72.0
TDN intake, lbs			
Diet	4.27	9.88	131.4
Supplement	-	1.34	-
Forage	4.27	8.54	100.0

[a]Data adapted from Gaebe et al., (1994).

The improvement in energy intake due to protein supplementation in this trial is higher than what is often reported; however, most research studies with supplemental protein for low-quality forages have resulted in similar trends. In situations where the goal of a supplementation program is to improve energy status of the animal through improved utilization of a low-quality forage, it may be possible to accomplish this through protein supplementation. It should be noted that forage must not be limited to improve energy status of animals grazing mature forages through protein supplementation. The key to success is the improvement in the utilization of the forage, however if forage is limited, the animal will not be able to increase its intake of forage and therefore, energy.

TYPES OF ENERGY SUPPLEMENTS

Although protein supplements provide some energy and may stimulate additional energy intake as discussed above, generally the term "energy supplement" refers to either cereal grains or by-products of the milling industry. In recent years, energy supplements have been classified into either those high in soluble carbohydrate (high in starches and sugars; cereal grains) or those high in structural carbohydrates (high in fiber; soybean hulls, wheat mids, beet pulp, etc.). Carbohydrates are the main energy yielding substrates for ruminal microbes, however the type of carbohydrate may have a major effect on the rate and extent of fiber digestion.

Several research studies have been conducted in the last few years on the effects of supplementing low-quality forage with cereal grains, primarily corn. Most of the research indicate that cereal grains will depress forage intake and digestion of the fiber fraction at higher levels (> .25% of body weight; Sanson and Clanton, 1989; Sanson et al., 1990). At lower levels of supplementation, depression in fiber utilization has been reported in some studies (Sanson and Clanton, 1989) but not in others (Chase and Hibberd, 1989). Research using gestating and lactating beef cows consuming low-quality forage supplemented with corn also has resulted in conflicting results. A research study in Nebraska indicated a negative effect of supplemental ear corn on gestating cows compared to a protein supplement (Rush et al., 1987). A more recent study in South Dakota indicates a positive response to corn compared to a protein supplement (Heldt, 1995).

Research using structural carbohydrates as supplements for low-quality forage is also inconsistent. Results from research with beef cows grazing native winter range in western South Dakota (Heldt, 1995) indicated that cows receiving wheat mids did not perform better than cows receiving a soybean meal supplement. In this study, cows that were supplemented with a combination of corn and soybean meal lost less weight than cows supplemented with either wheat mids or soybean meal. Research at Oklahoma State University with spring calving cows indicate that increasing the level of supplemental wheat mids increased the weight gain of cows prior to calving (Ovenell et al., 1989), however, with fall calving cows, supplemental wheat mids did not decrease weight loss during lactation (Cox et al., 1989). Other research conducted at Oklahoma State University with supplemental soybean hulls (Marston et al., 1992) indicate a positive response in weight change compared to soybean meal. The Oklahoma State research indicates that with low-quality forage both wheat mids and soybean hulls have similar energy values as corn when fed at less than 20% of the total diet.

FORAGE AVAILABILITY

Forage availability is important when choosing a supplement. The interaction between the supplement and forage will vary, depending on the level of forage intake. In situations where forage is limited, the proportion of the diet made up of the supplement will be higher. As discussed above, where forage is not limited, a protein will improve the utilization of the forage. A major portion of this improvement is due to an increase in forage intake. Although supplemental protein will improve the digestion of the low-quality forage, you will not get maximum benefit of the protein supplement if there is not adequate forage, since a large portion

of the increase in energy intake is due to the increase in intake.

When forage availability is low, and a high percentage of the diet energy is from the supplement, corn or other cereal grains may provide more energy than feedstuffs high in structural carbohydrates. When fed at less than 30% of the diet, the negative effect of the starch in cereal grains on low-quality forage tends to dilute out some of the additional energy provided by the cereal grains. Essentially, this lowers the TDN value of the corn. However, when the level of corn exceeds 30% of the diet, more than 50% of the diet energy is from corn. In this case, the book TDN value for corn appears more realistic.

Another important concept is that when forage is limited and either supplement or forage must be purchased, it is often cheaper to purchase energy in the form of grains or by-products than hay. In a situation like this, the primary goal is no longer to utilize the forage that is available, but to provide the needed nutrient requirements in the cheapest form. In many cases, the feeds high in non-structural carbohydrates are often the most economical.

WHAT IS THE BEST SUPPLEMENT FOR LOW-QUALITY FORAGES

Unlimited Low-Quality Forage: A natural-protein supplement will improve forage utilization in situations where forage is not limited. The improvement should be enough to meet the requirements for maintenance and for gestation. It will probably not be enough for non-fetal weight gain, and may actually result in slight tissue loss of the cow with a corresponding weight gain of the fetus. Forage utilization can only be improved so much. With lactating cows, although protein supplementation will help, you will not improve the utilization of the low-quality forage enough to meet the additional requirements for lactation and reproduction. Some additional energy will be required, or the cow will metabolize body stores. Assuming that the cows have access to unlimited low-quality forage, my preference is to use some high-fiber carbohydrate source in addition to the protein supplement. Although there are studies that indicate that corn or other cereal grains would also work here, I am still concerned about the effects of forage utilization, and since the forage is unlimited, I believe that we should try to get the most out of the forage possible.

Limited Low-Quality Forage: In this case, although a protein supplement will increase the digestibility of the forage by correcting a nitrogen deficiency in the rumen, the animal will not benefit from an increase in intake. If the amount of energy needed is large, the best source of supplemental energy is probably from corn or another cereal grain. If the grain is going to provide more than 50% of the total energy in the diet, the energy value of the corn appears to be similar to book values.

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